

# Materials Computation Center, University of Illinois

Duane Johnson and Richard Martin, NSF DMR-9976550

## *Multiscale Analysis of NEMS*

from co-PI: Narayan Aluru

### Research

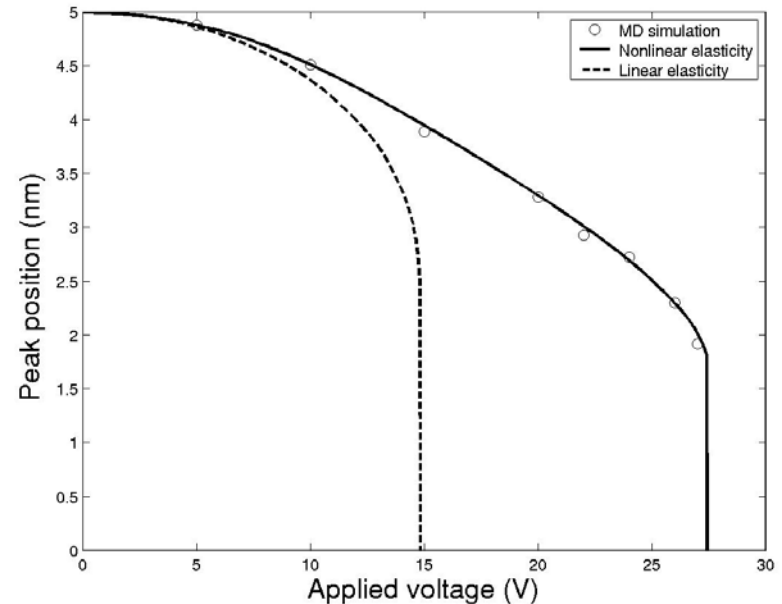
Our goal is to develop efficient multiscale simulations tools for analysis of silicon-based nanoelectromechanical systems (NEMS).

Accomplishments to date include:

- developed nonlinear continuum theories
- developed Dirichlet-Dirichlet and Dirichlet-Neumann based multiscale analysis

Plans for next 6–12 months are to develop efficient semi-classical and quantum-mechanical solvers to compute electrostatic forces on NEM devices.

(Collaboration with J.-P. Leburton.)



### Continuum theories for NEMS:

Comparison of linear and nonlinear continuum theories with molecular dynamics simulations for a fixed-fixed NEM switch with an initial gap of 5 nm. The beam is 21.72 nm long, 1.63 nm wide and 1.63 nm thick. Nonlinear continuum theories match well with molecular dynamics, while linear theories fail to predict the pull-in behavior of the switch.